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Dividends From Wood Research

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Recent Publications

January–June 2000

Explanation and Instructions

"Dividends From Wood Research" is a semiannual listing of recent publications resulting from wood utilization research at the Forest Products Laboratory (FPL). These publications are produced to encourage and facilitate application of Forest Service research. This issue lists publications received between January 1 and June 30, 2000.

Each publication listed in this brochure is available through at least one of the following sources.

Available from FPL (indicated by an order number before the title of the publication): Quantities limited. Circle the order number on the blank at the end of the brochure and mail or fax the blank to FPL.

Available through the Internet: Listed publications are available as PDF documents for viewing or printing from FPL's web site (http://www.fpl.fs.fed.us/).

Available through sales outlets: Major sales outlets are the Superintendent of Documents, the National Technical Information Service (NTIS), and various private publishers. Order directly from the outlet.

Available through libraries: Research publications are available through many public and university libraries in the United States and elsewhere. U.S. Government publications are also available through many Government Depository Libraries. Check with a major library near you to determine availability.

List of Categories

Publications are listed in this brochure within the following general categories:

- Biodiversity and Biosystematics of Fungi
- Decay Processes and Bioprocessing
- Durability
- General
- Papermaking and Paper Recycling
- Properties and Use of Wood, Composites, and Fiber Products
- Recycling of Wood Products
- Surface Chemistry
- Timber and Fiber Demand and Technology Assessment
- Wood Anatomy and Identification
- Wood Chemistry

Biodiversity and Biosystematics of Fungi

***Calocybe cyanea*—A Rare and Beautiful Agaric Is Discovered in Puerto Rico**

Baroni, Timothy J.; Legon, Nick W.; Vilgalys, Rytas; Lodge, D. Jean
1999. Mycologist. 13(1): 7–10.

Decay Processes and Bioprocessing

Research Group on Wood Preservation, 31st annual meeting; 2000 May 14–19; Kona, Hawaii. Stockholm, Sweden: The International Research Group on Wood Preservation

Properties of Particleboard Made From Recycled CCA-Treated Wood
Clausen, Carol A.; Kartal, Nami; Muehl, James
2000. *In*: Environmental aspects. Document IRG/WP 00–50146.

Evaluation of White-Rot Fungal Growth on Southern Yellow Pine Wood Chips Pretreated With Blue-Stain Fungi
Croan, Suki C.
2000. *In*: Biology. Sec. 1. Document IRG/WP 00–10349.

Inhibition of Termite Damage by N'N-napthaloylhydroxyamine (NHA): *Reticulotermes flavipes* (Kollar) vs. *Coptotermes formosanus* Shiraki
Green, Frederick, III; Lebow, Stan; Yoshimura, Tsuyoshi
2000. *In*: Biology. Sec. 1. Document IRG/WP 00–10354.

Bioprocessing Preservative-Treated Waste Wood
Illman, Barbara L.; Yang, Vina W.; Ferge, Les
2000. In: Environmental aspects. Sec. 5. Document IRG/WP 00–50145.

Efficacy of Pinosylvins Against White-Rot and Brown-Rot Fungi

Celimene, Catherine C.; Micales, Jessie A.; Ferge, Leslie; Young, Raymond A.
1999. Holzforschung. 53(5): 491–497.

Production of Polygalacturonase and Increase of Longitudinal Gas Permeability in Southern Pine by Brown-Rot and White-Rot Fungi

Green, Frederick, III; Clausen, Carol A.
1999. Holzforschung. 53(6): 563–568.

High Resolution Microtomography for Density and Spatial Information About Wood Structures

Illman, Barbara; Dowd, Besty
1999. *In*: Developments in X-ray tomography II. Proceedings, SPIE's 44th annual meeting and exhibition; 1999; July 18–23; Denver, CO. SPIE Proceedings 3772. Chicago, IL: International Society for Optical Engineering.

Feedstocks: New Supplies and Processing

Jeffries, Thomas W.; Lee, Y.Y.
1999. Appl. Biochem. Biotech. 77–79: 3–4.

Peroxyl Radicals Are Potential Agents of Lignin Biodegradation

Kapich, Alexander N; Jensen, Kenneth A.; Hammel, Kenneth E.
1999. FEBS Letters. 461: 115–119.

Fluorescent Labels, Confocal Microscopy, and Quantitative Image Analysis in Study of Fungal Biology

Spear, Russell, N.; Cullen, Daniel; Andrews, John H.
1999. *In*: Conn, P. Michael, ed. Confocal microscopy. Vol. 307. San Diego, CA: Academic Press: 607–623.

Optimum Growth Conditions of the Metal-Tolerant Wood Decay Fungus, *Meruliporia incrassata* TFFH 294

Yang, Vina W.; Illman, Barbara L.
1999. *In*: Proceedings of the International Research Group on Wood Preservation; 30th annual meeting; 1999 June 6–11; Rosenheim, Germany. Sec. 5, Environmental aspects. The Research Group on Wood Preservation. Document IRG/WP 99–50142.

Durability

Research Group on Wood Preservation, 31st annual meeting; 2000 May 14–19; Kona, Hawaii. Stockholm, Sweden: The International Research Group on Wood Preservation

Evaluation of New Creosote Formulations After Extended Exposures in Fungal Cellar Tests and Field Plot Tests
Crawford, Douglas, Lebow, Patricia K.; De Groot, Rodney C.
2000. *In*: Wood protecting chemicals. Sec. 3. Document IRG/WP 00–30228.

An Experimental Method to Simulate Incipient Decay of Wood by Basidiomycete Fungi
Curling, Simon; Winandy, Jerrold E.; Clausen, Carol A.
2000. *In*: Test methodology and assessment. Sec. 2. Document IRG/WP 00–20200.

Termite and Fungal Resistance of *in situ* Polymerized Tributyltin Acrylate and Acetylated Indonesian and USA Wood
Ibach, Rebecca, E.; Hadi, Yusuf Sudo; Nandika, Dodi; Yusuf, Sulaeman; Indrayani, Yuliati
2000. *In*: Wood protecting chemicals. Sec. 3. Document IRG/WP 00–30219.

Effect of Compression Wood on Leaching of Chromium, Copper, and Arsenic From CCA-C Treated Red Pine (*Pinus resinosa* Ait.)
Kartal, S. Nami; Lebow, Stan
2000. *In*: Wood protecting chemicals. Sec. 3. Document IRG/WP 00–30232.

Serviceability Modeling—Predicting and Extending the Useful Service Life of FRT-Plywood Roof Sheathing
Winandy, Jerrold E.
2000. *In*: Test methodology and assessment. Sec. 2. Document IRG/WP 00–20210.

Static and Vibration Moduli of Elasticity of Salvaged and New Joists

Cai, Zhiyong; Hunt, Michael O.; Ross, Robert J.; Soltis, Lawrence A.
2000. Forest Prod. J. 50(2): 35–40.

Treatability of U.S. Wood Species With Pigment-Emulsified Creosote

Crawford, Douglas M.; De Groot, Rodney C.; Watkins, John B.; Greaves, Harry; Schmalzl, Karl J.; Syers, T.L.
2000. Forest Prod. J. 50(1): 29–35.

▹ **1. Distribution of Borates Around Point Source Injections in Wood Members Exposed Outside**

De Groot, Rodney C.; Felton, Colin C.; Crawford, Douglas M.
2000. USDA Forest Serv. Res. Note FPL–RN–0275. 5 p.

In bridge timbers, wood decay is usually found where water has accessed the end-grain surfaces. In preservative-treated members, end-grain surfaces are most likely to be those resulting from on-site framing cuts or borings. Because these at-risk surfaces are easy to see, it seems feasible to establish a program where diffusible preservatives are repetitively inserted into those critical areas spatially distributed in a grid and on a schedule that will ensure protection, thereby extending the life of the entire structure. The objective of this study was to determine the vertical and lateral distribution and the post-treatment behavior of injected and inserted borate preservatives in wood exposed to natural wetting in field exposure. During this 1- and 2-year exposure, rain wetting elevated the moisture content of the wood enough to support growth of decay fungi in wood not protected by borates. Point source treatments consisted of either borate solutions or fused borate rods that were injected or inserted, respectively, into predrilled holes. The longitudinal movement of borates applied as either glycol or aqueous solutions was generally greater than that occurring with treatment of borate rods only. Lateral distribution of borates was similar among treatments. In Southern Pine, differences in both vertical and longitudinal movement of borate from the insertion holes were associated with the type of closure used. Results indicate that borates can be included in a maintenance program consisting of time-sequenced treatment of critical regions of wood bridges that are at risk for internal decay. Grids for placement of point sources of diffusible borates in engineered wood structures could be developed on a wood-species-specific basis. Such treatments would complement the exterior shell of protection provided by the original pressure treatment and enhance long-term durability.

Five-Year Field Trials Using Preservative-Treated, Second-Growth Douglas-fir Exposed in Ground Contact in Australia

De Groot, Rodney C.; Crawford, Douglas M.; Norton, Jack; Keith, John
2000. Forest Prod. J. 50(2): 46–53.

Natural Decay Resistance of Heartwood From Dead, Standing Yellow-cedar Trees: Laboratory Evaluations

De Groot, Rodney C.; Woodward, Bessie; Hennon, Paul E.
2000. Forest Prod. J. 50(1): 53–59.

Analytical Model of Flame Spread in Full-Scale Room/Corner Tests (IS09705)

Dietenberger, Mark; Grexa, Ondrej
1999. *In*: Proceedings of the 6th international conference and exhibition, of Fire and Materials '99; 1999 February 22–23; San Antonio, TX. London, United Kingdom: Interscience Communications Ltd.: 211–222.

▷ **2. Environmental Impact of Preservative-Treated Wood in a Wetland Boardwalk**

Forest Products Laboratory
2000. USDA Forest Serv. Res. Pap. FPL–RP–582. 126 p.

Forest Service, Bureau of Land Management, and industry partners are co-operating in a study of the leaching and environmental effects of a wetland boardwalk. The construction project is considered "worst case" because the site has high rainfall and large volumes of treated wood were used. Separate boardwalk test sections were constructed using untreated wood or wood treated with ammoniacal copper quat Type B (ACQ–B), ammoniacal copper zinc arsenate (ACZA), chromated copper arsenate Type C (CCA–C), or copper dimethyldithiocarbamate.

Part I of this report focuses on leaching of preservative components. Surface soil, sediment, and water samples were removed before construction and at intervals after construction to determine the concentrations and movement of leached preservatives. The preservatives released measurable amounts of copper and/or chromium, zinc, or arsenic into rainwater collected from the wood, and elevated levels of preservatives were found in the soil and/or sediment adjacent to the treated wood. With few exceptions, elevated environmental concentrations of preservative components were confined to within close proximity of the boardwalk.

Part II of this report focuses on the effects of boardwalks treated with CCA, ACZA, and ACQ–B on populations of aquatic invertebrates. The experimental variables were total species richness (total number of taxa), total sample abundance (number of organisms/sample), dominant sample abundance (≥1% total specimens in vegetation, artificial substrate, and infaunal samples), and Shannon's and Pielou's indices. The infaunal samples contained the largest mean number of animals and the highest total taxa richness. Although measurable increases occurred in water column and sediment preservative concentrations, no taxa were excluded or significantly reduced in number by any preservative treatment.

▷ **3. Stress Wave Timing Nondestructive Evaluation Tools for Inspecting Historic Structures**

Forest Products Laboratory
2000. USDA Forest Serv. Gen. Tech. Rep. FPL–GTR–119. 15 p.

This guide was prepared to assist inspectors in the use of stress wave timing instruments and various methods of locating and defining areas of decay in timber members in historic structures. The first two sections provide (a) background information regarding conventional methods to locate and measure decay in historic structures and (b) the principles of stress wave nondestructive testing and measurement techniques. The last section is a detailed description of how to apply the use of stress wave nondestructive testing methods in the field. A sample field data acquisition form and additional reference material are included in the Appendix. This guide includes all the information needed to begin to utilize and interpret results from stress wave timing nondestructive evaluation methods.

▷ **4. Role of Construction Debris in Release of Copper, Chromium, and Arsenic From Treated Wood Structures**

Lebow, Stan T.; Halverson, Steven A.; Morrell, Jeffrey J.; Simonsen, John
2000. USDA Forest Serv. Res. Pap. FPL–RP–584. 6 p.

Recent research on the release of wood preservatives from treated wood used in sensitive environments has not considered the potential contribution from construction residues. This study sought to develop leaching rate data for small construction debris and compare those to the release rate from treated wood itself. Western hemlock boards were pressure treated with chromated copper arsenate Type C (CCA-C), and then common construction tools were used to generate sawdust or shavings from those boards. These wood particles were then leached in deionized water, and the leaching rate was compared with that of solid wood samples cut from the same specimen. Release rate data from this study were also compared with those from end-matched samples that were leached in artificial rain in an earlier study. The release rates of copper, chromium, and arsenic from CCA-C treated chain saw sawdust, circular saw sawdust, and spade bit shavings were many times higher than from solid wood when samples were immersed in water. There was little difference in the release rates among the three types of shavings and sawdust, despite differences in their particle sizes. The rates of release from decking exposed to rainfall were many times lower than that of construction debris or solid wood continually immersed in water. These results show the importance of minimizing the amount of construction debris that is allowed to enter the aquatic environment. However, example calculations also demonstrate that if reasonable efforts are made to minimize release of construction debris, the contribution of these particles to the overall release of preservative from the structure will be minimal.

Using Sound to Evaluate Standing Timber

Ross, Robert R.
1999. International Forestry Rev. 1(1): 43–44.

▷ **5. Method for Adjusting Warp Measurements to a Different Board Dimension**

Simpson, William T.; Shelly, John R.
2000. USDA Forest Serv. Res. Note FPL–RN–0273. 3 p.

Warp in lumber is a common problem that occurs while lumber is being dried. In research or other testing programs, it is sometimes necessary to compare warp of different species or warp caused by different process variables. If lumber dimensions are not the same, then direct comparisons are not possible, and adjusting warp to a common dimension would be desirable so that these comparisons are possible. In this report, two methods of adjusting warp to different dimensions are developed—one based on the geometry of bow and crook and another based on the geometry of twist. These methods provide a way to adjust crook and bow measurements to a different length and to adjust twist to a different length or width so that comparisons are possible.

Repair of White Oak Glued-Laminated Beams

Soltis, Lawrence A.; Ross, Robert J.
1999. *In*: Bank, Lawrence C., ed. Materials and construction—Exploring the connection. Proceedings, 5th ASCE materials engineering congress; 1999 May 10–12; Cincinnati, OH. Reston, VA: American Society of Civil Engineers: 116–123.

▷ **6. Nondestructive Methods of Evaluating Quality of Wood in Preservative-Treated Piles**

Wang, Xiping; Ross, Robert J.; Erickson, John R.; Forsman, John W.; McGinnis, Gary D.; De Groot, Rodney C.
2000. USDA Forest Serv. Res. Note FPL–RN–0274. 9 p.

Stress-wave-based nondestructive evaluation methods were used to evaluate the potential quality and modulus of elasticity (MOE) of wood in used preservative-treated Douglas-fir and southern pine piles. Stress wave measurements were conducted on each pile section. Stress wave propagation speeds in the piles were then obtained to estimate their MOE. This was followed by a sequence of tests conducted on octagon-shaped cants, on boards, and on small, clear wood specimens obtained from the piles. Statistical regression analyses revealed a strong correlation between the stress-wave-based MOE (MOE_d) of piles and octagons and the corresponding flexural properties of boards and small, clear wood specimens determined by transverse vibration and static bending techniques, respectively. The results also indicated that used preservative-treated wood piles still contain material that has potential for use in exterior structural applications.

▷ **7. Strength and Stiffness Assessment of Standing Trees Using a Nondestructive Stress Wave Technique**

Wang, Xiping, Ross, Robert J.; McClellan, Michael; Barbour, R. James; Erickson, John R.; Forsman, John W.; McGinnis, Gary D.
2000. USDA Forest Serv. Res. Pap. FPL–RP–585. 9 p.

Nature's engineering of wood through genetics, stand conditions, and environment creates wide variability in wood as a material, which in turn introduces difficulties in wood processing and utilization. Manufacturers sometimes find it difficult to consistently process wood into quality products because of its wide range of properties. The primary objective of this study was to investigate the usefulness of a stress wave technique for evaluating wood strength and stiffness of young-growth western hemlock and Sitka spruce in standing trees. A secondary objective was to determine if the effects of silvicultural practices on wood quality can be identified using this technique. Stress wave measurements were conducted on 168 young-growth western hemlock and Sitka spruce trees. After *in situ* measurements, a 2-ft-(0.61-m-) long bole section in the test span was taken from 56 felled trees to obtain small, clear wood specimens. Stress wave and static bending tests were then performed on these specimens to determine strength and stiffness. Results of this study indicate that *in situ* stress wave measurements could provide relatively accurate and reliable information that would enable nondestructive evaluation of wood properties in standing trees.

Wildland/Urban Interface Fire Research at the USDA Forest Service, Forest Products Laboratory: Past, Present, and Future

White, Robert H.
2000. *In*: Proceedings of the 30th international conference on fire safety; 12th international conference on thermal insulation; 4th international conference on electrical and electronic products; 2000 January 24–27; White Sulphur Springs, WV. Sissonville, WV: Product Safety Corporation: 33–43.

General

Ecosystem Management and the Use of Natural Resources

Johnson, Marlin; Barbour, James; Green, David W.; Willits, Susan; Znerold, Michael; Bliss, James D.; Chiang, Sie Ling; Toweill, Dale
1999. *In*: Szaro, R.C.; Johnson, N.C.; Sexton, W.T.; Malk, A.J., eds. Ecological stewardship—A common reference for ecosystem management. Humans as agents of ecological change. Amsterdam, The Netherlands: Elsevier Science: Vol. 2: 558–582.

Extending the Forest Resource: 90 Years of Progress at the Forest Products Laboratory

Zerbe, John I.; Green, Phyllis A.D.
1999. Forest History Today. (Fall)

Papermaking and Paper Recycling

Proceedings of the 1999 TAPPI International Pulping Conference; 1999 April 18–21; Nashville, TN. Atlanta, GA: TAPPI Press.

Innovative Approach to Solving "Stickies" Problem and Developing Environmentally Benign Pressure Sensitive Adhesives Through Partnerships
AbuBakr, Said; Peng, Joe
1999. Vol. 2: 763–765.

Closed-Mill Delignification by Design Using Polyoxometalates
Houtman, C.J.; Reiner, R.S.; Reihel, S.E.; Birchmeier, M.J.; Sullivan, C.E.; Weinstock, L.A.; Atalla, R.H.
1999. Vol. 2: 819–829.

Reduction of Greenhouse Gasses by Fiber-Loaded Lightweight, High-Opacity Newsprint Production
Klungness, John H.; Stroika, Matthew, L.; AbuBakr, Said M.
1999. Vol. 1: 123–127.

Small-Diameter Trees Used for Chemithermomechanical Pulps
Myers, Gary C.; Barbour, R. James; AbuBakr, Said
1999. Vol. 2: 481–490.

Rheology and Extrusion of Low-Grade Paper and Sludge
Scott, C. Tim; Zauscher, Stefan; Klingenberg, Daniel J.
1999. Vol. 2: 685–690.

Biotechnology: Working With Nature to Improve Forest Resources and Products
Sykes, Marguerite; Yang, Vina; Blankenburg, Julie; AbuBakr, Said
1999. Vol. 2: 631–637.

Recycling Evaluation of New-Generation Environmentally Benign Pressure Sensitive Adhesives

AbuBakr, Said; Houtman, Carl; Bormett, Dave; Ross Sutherland, Nancy
1999. *In*: The Adhesive and Sealant Council, Inc., 1999 spring convention and expo; 1999 April 11–14; Toronto, Canada. Bethesda, MD: Adhesive and Sealant Council, Inc.: 3 p.

Biomechanical Pulping: A Mill-Scale Evaluation

Akhtar, Masood; Scott, Gary M.; Swaney, Ross E.; Lentz, Mike J.; Horn, Eric G.; Sykes, Marguerite S.; Myers, Gary C.
1999. *In*: Proceedings, 1998 TAPPI international mechanical pulping conference; 1999 May 24–26; Houston, TX. Atlanta, GA: TAPPI Press: 1–10.

Compatibility of Pressure Sensitive Adhesives With Recycling Unit Operations

Bormett, David; Houtman, Carl; Abubakr, Said; Peng, Joseph
1999. *In*: Brogdon, Brian N.; Hart, Peter W.; Walker, Colleen C.; eds. Fundamental advances and innovations in the pulp and paper industry. New York, NY: American Institute of Chemical Engineers: AIChE Symposium Series 322. 95: 159–164.

Quantification of Micro Stickies

Doshi, Mahendra; Dyer, Jeffrey; Aziz, Salman; Jackson, Kristine; Abubakr, Said
1999. *In*: Doshi, Mahendra R.; Dyer, Jeffrey J., eds. Paper recycling challenge: Vol. IV. Process control and mensuration. Appleton, WI: Doshi & Assoc.: 119–122.

Nonlinear Finite Element Modeling of Corrugated Board

Gilchrist, A.C.; Suhling, J.C.; Urbanik, T.J.
1999. *In*: Perkins, Richard, ed. Mechanics of cellulosic materials–1999. Proceedings, ASME joint applied mechanics and materials division meeting; 1999 June 27–30; Blacksburg, VA. New York, NY: The American Society of Mechanical Engineers. AMD–Vol. 231/MD-Vol. 85: 101–106.

Determining the Minimum Conditions for Soda-AQ Pulping of Kenaf Bast, Core, and Whole Stalk Fibers

Han, James S.; Rymsza, Thomas A.
1999. *In*: Fiber for our future. Proceedings, second annual American Kenaf Society conference; 1999 February 25–26; San Antonio, TX. Vernon, TX: American Kenaf Society.

Properties of Kenaf From Various Cultivars, Growth and Pulping Conditions

Han, James S.; Miyashita, Ernest S.; Spielvogel, Sara J.
1999. *In*: Kenaf properties, processing and products. Jackson, MS: Mississippi State University. Ag & Bio Eng.: 267–283. Chap. 23.

Lightweight, High-Opacity Paper: Process Costs and Energy Use Reduction

Klungness, John H.; Pianta, Fabienne; Stroika, Mathew L.; Sykes, Marguerite; Tan, Freya; AbuBakr, Said
1999. *In*: Brogdon, Brian N.; Hart, Peter W.; Walker, Colleen C.; eds. Fundamental advances and innovations in the pulp and paper industry. New York, NY: American Institute of Chemical Engineers: AIChE Symposium Series 322. 95: 99–102.

Engineering Analysis of Lightweight High-Opacity Newsprint Production by Fiber Loading

Klungness, John H.; Stroika, Matthew L.; Sykes, Marguerite S.; AbuBakr, Said M.; Witek, Werner; Heise, Oliver U.
1999. *In*: Proceedings of TAPPI 99 preparing for the next millennium; 1999 March 1–4; Atlanta, GA. Atlanta, GA: TAPPI Press: 1047–1053.

Semiannual Patents Review —July–December 1998

Stroika, Matthew; Sykes, Marguerite; Blankenburg, Julie
1999. Progress in Pap. Recycl. 8(3): 58–64 (May).

Ultrafiltrative Deinking of Flexographic ONP: The Role of Surfactants

Upton, Bradley H.; Krishnagopalan, Gopal A.; Abubakr, Said
1999. Tappi J. 82(11): 104–114.

Properties and Use of Wood, Composites, and Fiber Products

Bending Properties of Laminated-Lumber Girders

Bohnhoff, D.R.; Moody, R.C.
2000. Appl. Eng. Agric. 16(2): 165–173.

▷ **8. Performance of Back-Primed and Factory-Finished Hardboard Lap Siding in Southern Florida**

Carll, Charles; Knaebe, Mark; Malinauskas, Vyto; Sotos, Peter; TenWolde, Anton
2000. USDA Forest Serv. Res. Pap. FPL–RP–581. 36 p.

Because of performance problems with hardboard siding in southern Florida, the U.S. Department of Housing and Urban Development proposed a local standard requiring prefinishing of siding and priming of all siding surfaces, including the back. However, the effectiveness of these practices was questioned. To determine if back-priming or factory finishing improves durability and performance of hardboard siding, we installed factory-finished and factory-primed siding on two buildings in southern Florida. The buildings were identical except that one had gutters and no overhangs and the other had overhangs and no gutters. Half the siding was back-primed and half was not. Moisture content, temperature, and air pressure difference across the siding were continuously monitored for 2 years. Condition and thickness of siding boards were recorded every 3 months. After removal from the buildings, siding was inspected and final moisture contents were determined. The siding was in excellent condition after about 2½ years of outside exposure. There was no evidence that back-priming the siding reduced its in-service moisture content. Whether the siding was from the overhang building or the guttered building did not seem to make a difference, but inspection of the windows and final moisture contents of the trim strongly suggested that overhangs provided additional protection on the gable ends (gutters were only present on the sidewalls).

Dimensional Stability and Decay Resistance of Composite Fiberboard Made From Plantation-Grown Southern Yellow Pine

Chow, Poo; Harp, Timothy
1999. *In*: ICEUPT'99: international conference on effective utilization of plantation timber—"timber and wood composites for the next century"; 1999 May 21–23; Chi–Tou, Taiwan ROC. Chi–Tou, Taiwan ROC: Forest Products Association of ROC. 16: 115–116.

Mechanical Holding Power of Melt-Blend Boards Made From Recycled Plastic and Kenaf

Chow, Poo; Bowers, Tait; Bajwa, Dilpreet S.; Youngquist, John A.; Muehl, Jim H.; Krzysik, Andrezej M.
1999. *In*: Fiber for our future. Proceedings, second annual American Kenaf Society conference; 1999 February 25–26; San Antonio, TX. Vernon, TX: American Kenaf Society.

Dynamic Fracture Toughness of Cellulose-Fiber-Reinforced Polypropylene: Preliminary Investigation of Microstructural Effects

Clemons, Craig M.; Caulfield, Daniel F.; Giacomin, A. Jeffrey
1999. J. Elastomers and Plastics. 31: 367–378.

▷ **9. Grading Options for Western Hemlock "Pulpwood" Logs From Southeastern Alaska**

Green, David W.; McDonald, Kent A.; Dramm, John; Kilborn, Kenneth
2000. USDA, Forest Serv. Res. Pap. FPL–RP–583. 15 p.

Properties and grade yield are estimated for structural lumber produced from No. 3, No. 4, and low-end No. 2 grade western hemlock logs of the type previously used primarily for the production of pulp chips. Estimates are given for production in the Structural Framing, Machine Stress Rating, and Laminating Stock grading systems. The information shows that significant amounts of higher grade structural lumber can be produced from these lower grade logs.

Stormwater Filtration of Toxic Heavy Metal Ions Using Lignocellulosic Materials Selection Process, Fiberization, Chemical Modification, and Mat Formation

Han, James S.
1999. *In*: Proceedings, 2nd Inter-regional conference on environment–water 99; 1999 September 1–4; Lausanne, Switzerland.

Validity of Plant Fiber Length Measurement—A Review of Fiber Length Measurement Based on Kenaf as a Model

Han, James S.; Mianowski, Theodore; Lin Yi-yu
1999. *In*: Kenaf properties, processing and products. Jackson, MS: Mississippi State University. Ag & Bio Eng.: 149–167. Chap. 14.

Stormwater Filtration of a Municipal Detention Pond

Han, James S.; Miyashita, Ernest S.; Lin, Yi-yu; Roa, Aicardo
1999. *In*: Kenaf properties, processing and products. Jackson, MS: Mississippi State University. Ag & Bio Eng.: 472–485. Chap. 39.

Know Your Fibers: Process and Properties or (A Material Science Approach to Designing Pulp Molded Products)

Hunt, John F.
1999. *In*: Proceedings, 4th international molded pulp packaging seminar; 1999 November 19; Chicago, Il. Mequon, WI: International Molded Pulp Environmental Packaging Association: 16 p.

Part II—Modelling the Drying of Three-Dimensional Pulp Moulded Structures—Drying Data Obtained From Flat Panels Using Virgin and Recycled Paper Fibre

Hunt, J.F.; Tamasy–Bano, M.; Nyist, H.
1999. *In*: Proceedings of the 4th international conference on the development of wood science, wood technology and forestry; 1999 July 14–16; Missenden Abbey, UK. High Wycombe, Buckinghamshire, England: 195–205.

Nonparametric Bayesian Predictive Distributions for Future Order Statistics

Johnson, Richard A.; Evans, James W.; Green, David W.
1999. Statistics & Probability Letters 41: 247–254.

Mechanical Grading of Oak Timbers

Kretschmann, David E.; Green, David W.
1999. J. Mat. Civil Eng. 11(2): 91–97. (May)

Medium Density Fiberboards From Plantation-Grown *Eucalyptus saligna*

Krzysik, Andrzej M.; Youngquist, John H.; Muehl, James H.; Franca, Fabio Spina
1999. *In*: ICEUPT'99: international conference on effective utilization of plantation timber–"timber and wood composites for the next century;" 1999 May 21–23; Chi–Tou, Taiwan ROC. Taiwan ROC: Forest Products Association of ROC: 16: 156–160.

Effect of Fire-Retardant Treatment on Plywood pH and the Relationship of pH to Strength Properties

Lebow, S.T.; Winandy, J.E.
1999. Wood Sci. Technol. 33: 285–298.

Oil Sorption by Lignocellulosic Fibers

Lee, Beom–Goo; Han, James S.; Rowell, Roger M.
1999. *In*: Kenaf properties, processing and products. Jackson, MS: Mississippi State University. Ag & Bio Eng.: 423–433. Chap. 35.

Evaluation of Nail Dowel Bearing Strength Expression

Rammer, Douglas R.
1999. *In*: Avent, R. Richard; Alawady, Mohamed, eds. Structural engineering in the 21st century. Proceedings, 1999 structures congress; 1999 April 18–21; New Orleans, Louisiana. Reston, VA: American Society of Civil Engineers: 634–637.

Changes in Kenaf Properties and Chemistry as a Function of Growing Time

Rowell, Roger M.; Han, James S.
1999. *In*: Kenaf properties, processing and products. Jackson, MS: Mississippi State University. Ag & Bio Eng.: 33–41. Chap. 3.

Properties of Kenaf/Polypropylene Composites

Rowell, Roger M.; Sanadi, Anand; Jacobson, Rod; Caulfield, Dan
1999. *In*: Kenaf properties, processing and products. Jackson, MS: Mississippi State University. Ag & Bio Eng.: 381–392. Chap. 32.

Steam Has Potential to Reduce Thickness Swell but Obstacles Must Be Overcome

Spelter, Henry
1999. Panel World. (Sept.) 49–51.

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